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ANNEX H TO 8TH QUARTERLY REPORT

ANNEX H TO 8TH QUARTERLY REPORT OF THE HUNTON & WILLIAMS

The Hunton & Williams Kiev Project Office seeks, and treats, advice from Mr. Adams as a form of internal project self-analysis. We then apply his recommendations as tempered by our own assessment of issues and of practical implementation. Thus, the attached report is intended as advice to Hunton & Williams, and was not presented in this form to counterparts. Mr. Adams does however consult directly with our counterparts from NERC, the Energomarket, the Ukrenergo, and others, when in Kiev. See also our 8th Quarter Report especially at Part C.3.4.

Suggested Solutions for the Ukrainian Wholesale Electricity Market

A Report by Ivan Adams for Hunton & Williams

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Contents

1. Executive Summary

This report is in part provided as responses to specific questions about the development of the Ukrainian wholesale electricity market (WEM). Where possible, recommendations are included to indicate the preferred direction that the WEM should take, recognizing where specific requirements have to be addressed. Criticisms of the existing WEM structure are included in this report only to illustrate the benefits of alternative options that are considered to be more in line with competitive market economics.

The main recommendations are as follows. Details are contained in the main body of the report at the section referenced below:

- (Section 4.2) A key factor that determines the success or otherwise of wholesale electricity markets is market governance. NERC needs to be a prime mover in making sure that the governance is inclusive but bureaucracy should be avoided.
- (Section 4.3) It is recognized that the preferred model for Phase 1 is a multilateral agreement but if this position is not obtained, the existing single buyer entity should be managed by specific regulation to mitigate the potential for undue influence.
- (Section 4.4) NEK Ukrenergo has two very separate roles within the electricity market of Ukraine – System Operator and Transmission Operator. It would be beneficial, particularly from a regulatory aspect, for these separate roles to be clearly delineated, preferably by separate licenses.
- (Section 4.5 and Appendix 2) Funds clearance is one of the biggest issues in the Ukrainian electricity market. Ultimately, Phase 2 would provide the benefit of ensuring that financial settlement is mainly is a matter for bilateral contracts. Now and in Phase 1, however, because all of the energy cost goes through the pool, a means of managing funds clearance has to be found that it less prone to manipulation. In other markets, funds clearance is a relatively straightforward matter. All that is required is for the funds administrator to be sufficiently independent to apply the rules and for there to be an open and transparent audit arrangement.
- (Section 4.6.1) There should be an obligation to make offers when plant capacity is technically available (except that Generators should be allowed to declare plant "mothballed" – (Section 4.6.2).
- (Section 4.6.3) Although the WEM is a one-sided market, it is believed that there is significant scope for demand side participation from large customers, which should lead to benefits of peak shaving and cost reduction.
- (Section 4.6.3) The requirements for system reserve should be made more transparent, possibly by the publication of relevant documentation by NEK Ukrenergo.
- (Section 4.7) Metering and data management is often more complex than it seems and the potential problems in this area should not be underestimated.
- (Section 4.8) During Phase 1 there would be advantages in operating a (financial) contract market, which will require regulation by NERC. This could involve the rationing of the "cheap" nuclear and hydro contracts.
- (Section 5.1.1) Price caps should only apply to limit the extreme price levels – not, as at present, set close to average SMP.
- (Section 5.1.2) The Capacity Price should be based on a pre-determined value, set by NERC according to the expected availability margin, rather than the present method of relating the level to the actual availability margin in each hour. This would provide greater certainty and would therefore be more likely to encourage short-term availability.

- (Section 5.1.5) An analysis of pool prices indicates that there is too much regulatory intervention in price determination. Prices are not low; indeed they are close to international wholesale price levels. More competition is required to put downward pressure on prices since regulation cannot achieve this alone.
- (Section 5.2) Thermal Generators should be allowed, as far as possible, to make competitive price offers. Regulation of the price offers should be limited to random sample checks rather than intrusive regulation.
- (Section 5.3) Nuclear plant could be allowed to make competitive price offers but in any case, even if price regulated, nuclear plant should be included in the availability bids and provided with an incentive to maximize its availability by applying the Capacity Price to nuclear generation.
- (Section 5.4) Hydro plant will continue to be price regulated but it would be beneficial to explore an alternative form of remuneration for hydro plant – payment for capacity rather than energy.
- (Section 5.5) CHP and other generation should be treated as for thermal plant.
- (Section 5.9) NEK Ukrenergo should procure ancillary services by competitive tender where practical to do so.
- (Section 6) Various proposals for market monitoring by are recommended, in order that incentives can be placed on participants and the NERC can take action to improve market competitiveness. Specifically, it is recommended that NERC should be encouraged to use a simple stacking model, as produce by Hunton & Williams, for this purpose. By effective market monitoring, NERC could be in a position to lead reforms by introducing well-informed discussion.
- (Section 7) Economic mechanisms for reliability are inherent in competitive markets. However, During Phase 1, it is not recommended that Suppliers should be required to forecast their own demand, since this would be less effective than the centralized forecast currently produced by the Market Operator.
- (Section 8) Although there are various options for dealing with international trade, exports and imports can be handled in much the same way as other trades. All that is required is the formation of a class of "External Party" to the WEM.

2. Purpose and Scope

The purpose and scope of this report is to develop details for Hunton & Williams's suggested solutions for Wholesale Energy Market ("WEM") problems in the context of the WEM concept work currently being conducted in Ukraine by Hunton & Williams, in particular regarding the following issues:

a) pricing for generation (system marginal price and capacity payments);
b) market monitoring by the regulator;
c) economic mechanisms to guarantee reliability and quality of supply at the wholesale level;
d) high voltage transmission pricing[1]; and
e) export/import relationships and pricing.

In addition, the report makes reference to the dispatch model developed by Hunton & Williams and on possible ways of using the dispatch model and financial analysis for market monitoring by NERC, especially for detecting risks or incidents of market power abuse.

[1] It was subsequently agreed to concentrate on wholesale market issues rather than include a section on transmission pricing in this report.

3. Background

In November 2001, a report[2] was produced for Hunton & Williams, which identified a number of specific recommendations for possible changes to the Ukrainian Wholesale Electricity Market (WEM). Since that time, detailed discussions have taken place in the forum of The WEM Concept Commission, concerning the implementation of changes to the WEM. This current report makes suggested solutions to the issues that are currently being discussed in that forum.

Documents used as points of reference for this report are:

- List of Problems of the Operation of the Wholesale Electricity Market of Ukraine – document, drafted by The WEM Concept Commission.
- Outline structure for a document – "Concept of the Operation and Development of the Wholesale Electricity Market of Ukraine".
- Directions of further development of the WEM of Ukraine – being Section 5 of the above document, drafted by Hunton & Williams.
- Modeling of the stack order for the Economic Dispatch of the Thermal Power Units in the Ukrainian Wholesale Electricity Market – internal document produced by Hunton & Williams.
- Wholesale Electricity Market Prices in Ukraine – internal document produced by Hunton & Williams.

Currently the WEM is operated in a significantly different way from that envisaged at the time when the original WEM was designed and implemented, some years ago. The original market rules were embodied in the Energomarket Members' Agreement (November 1996). The original Agreement has been changed many times, mainly to the Schedules and is now known as the Wholesale Electricity Market Members' Agreement (WEMMA). Although the basic market rules for operation of the WEM remain, significant regulatory/government intervention applies, particularly with regard to generation pricing.

The reforms to the WEM are planned to take place in two distinct phases:

- Phase 1 – retention of the existing market structure (i.e. a gross energy pool where all of the energy produced is supplied at the wholesale level through the pool) but with changes aimed to make the WEM more effective than at present. This is the Hunton & Williams model.
- Phase 2 – a move to a new structure of a voluntary bilateral contract market and a mandatory balancing market for imbalances between contracted and physical positions. This is the general opinion.

The suggested solutions contained in this report are largely confined to Phase 1. However, implications for Phase 2 are discussed, where relevant.

During The WEM Concept Commission discussions, it emerged that certain specific entities' requirements need to be accommodated in Phase 1. These are:

[2] "Recommendations concerning possible changes to the Ukrainian Wholesale Electricity Market".

- The need to deal with the difficulties caused by the existence of the Single Buyer, either by moving away from the Single Buyer concept or to ensure that the role of the Single Buyer is limited or controlled in such a way as to mitigate the difficulties.
- The need to retain regulated pricing of hydro and nuclear generation.
- The desire to achieve a degree of market liberalization, by allowing large customers to contract directly with Generators – possibly by way of a "Liberalized Single Buyer Model".

Some of the above requirements may be conflicting. In particular, to retain the regulated pricing of generation pricing is likely to require certain restrictions to be put in place when liberalizing the market.

This report deals with many of the issues relating to the implementation of Phase 1 and suggests solutions for accommodating the specific requirements that have arisen during The WEM Concept Commission discussions.

4. The Market Structure in Phase 1

4.1. Generation and Supply Licenses

In order to ensure equity between Oblenergos and other Suppliers, consideration is being given to allow Oblenergos to supply at unregulated tariffs as well as regulated tariffs. This is a necessary step prior to any liberalization of the market by way of retail competition.

4.2. The Market Administration Company and Market Governance

Extract from "Strategic Direction" document:
"The Spot Market will be operated by the Market Administration Company (the Market Operator) – a CJSC owned by the market members. The Market Administration Company will not buy or sell electricity and will not be a market member. The Market Administration Company finances its activities through fees paid by the Market Members."

Governance of the Market Operator is likely to be a critical factor in determining the successful implementation of Phase 1. In other wholesale electricity markets, governance has played a key part in the failures and success. The important thing is to get an appropriate balance between accountability and manageability. The likelihood is that there will be a tendency to make the governance too bureaucratic. This should be avoided. Some independent influence, either by customer representation or others, would be appropriate but such influences should not dominate the structure. The key figure is NERC – recognizing that it is a regulated market; NERC has the main responsibility for ensuring that the market operates according to the strategic direction agreed at the outset. Thus, NERC will need to have an ultimate power of decision, should there not be agreement among market participants.

4.3. Single Buyer or Multilateral Agreement

The issue of whether or not the Market Operator takes title (i.e. a single buyer) is not quite as fundamental as it may seem. The following are the main concerns about the single buyer entity:

- It may be susceptible to government interference;
- It may have access to the market funds;
- It may preclude the development of commercial trading between Generators and Suppliers; and
- It may have undue influence on the development of the market structure and possibly the amount and type of capacity built.

It is possible, however, to retain a single buyer concept for the Market Operator whilst ensuring that each of the above concerns is minimized, by specific regulations. Retaining the single buyer concept but dealing with the specific concerns may be more achievable in the short-term than attempting to reinstate the original concept of a multilateral agreement.

4.4. The Role of NEK Ukrenergo

Extract from "Strategic Direction" document:
"System operation (scheduling and dispatch and management of system security and reliability) and high voltage network operation will be performed by NEK Ukrenergo. NEK Ukrenergo will have an exclusive license for system operation and high-voltage network operation on the territory of Ukraine, including the purchase of system (ancillary) services in its function as System (ancillary) Services Provider. The license will specify, among other

things, the responsibility of Ukrenergo for short-term and long-term system reliability and its obligation to dispatch generation in accordance with the stack order determined by the Market Operator and with its own contracts for the purchase of system (ancillary) services. NEK Ukrenergo finances its activities through a high-voltage transmission and dispatch tariff. The fee and the tariff are regulated by NERC."

There would be a significant advantage in ensuring that regulation of the transmission tariff is separate from the regulation of the System Operator function (to ensure that the two activities are not cross subsidized and to provide NERC with a means of incentivizing the two activities appropriately). There may also be scope for directly incentivizing NEK Ukrenergo by a system of targets, with penalties and bonuses for under/over achievement.

For example:

- In its role as the provider and operator of the Transmission System, NEK Ukrenergo could be given an incentive to minimize the transmission system losses, by setting a target level of losses for the year. Financial penalties would apply if the actual losses exceeded the target level but a bonus would apply if actual losses were less than the target. The target would need to be set based on historic values, plus a reasonable assumption for improvement.
- In its role as System Operator, NEK Ukrenergo could be given an incentive to minimize the costs associated with obtaining and utilizing ancillary services, by setting a target level[3] of costs for the year ahead. Penalties would apply if actual costs exceeded the target but a bonus would apply if costs were kept below the target level. Preferably, separate target costs should be set for each type of ancillary service provided by the System Operator.

In its scheduling and dispatch role, NEK Ukrenergo is providing two functions:

- System management, which includes plant scheduling and dispatch; and
- Market operations, essentially acting as an agent of the Market Operator.

This dual function could be clarified by recognizing the agency role within the WEMMA. Thus, there should be no conflict between scheduling and dispatch for system operation and for market operation. There is still a certain amount of confusion about which entity is responsible for various functions. In order to help clarify these points, discussions were held with representatives of the System Operator and the Market Operator. The results of these discussions are summarized in this report as Appendix 1.

Generally, there is in fact less confusion than appears to be so. The split of activities between the System Operator and Market Operator is both practical and in line with principles of the wholesale market. The Market Operator receives the Generator price and availability offers, via Regional control centers and produces a central forecast of demand on an hourly basis for the day ahead. From the Generator offers and its demand forecast, the Market Operator produces a generation schedule, utilizing appropriate software. This software also determines the System Marginal Price (SMP). The System Operator schedules and dispatches plant in accordance with the schedule produced by the Market Operator, managing frequency and voltage according to any transmission constraints, demand changes and generation shortfall.

[3] A refinement would be to have lower and upper targets with a "dead band" between the two targets, to allow for uncertainty. The penalties would apply above the upper level and bonuses below the lower level.

4.5. Settlement and Funds Administration

Settlement is a responsibility of the Market Operator. The function will involve the creation of a settlement system, which is really in two parts:

(1) A system to prepare statements, for each Trading Period, showing how much each Generator is to be paid and how much each Supplier has to pay; and
(2) A clearing system to enable funds to be transferred in accordance with the statements. This would need to be linked to the credit cover rules that would apply in Phase 1.

The timescale for the implementation of Phase 1 needs to allow for the specification, design, build and testing of these systems.

Funds administration could be separate from settlement or combined as part of the responsibilities of the Market Operator. The main issue is to ensure that the entity responsible for funds administration has no recourse to the funds. This will require strict financial control and all funds clearance should take place on agreed settlement dates.

The issue of funds clearance is very significant in Ukraine and there is much concern about the practicality of operating a funds clearance system. Since Ukraine has a gross energy pool, all of the payments for purchase and sale of energy flow through the pool. Phase 2 will reduce the significance of this central funds clearance to a relatively small residual amount. During Phase 1, however, funds still need to be cleared for the gross amount of energy traded.

Appendix 2 provides examples of the practical implementation of funds clearance in other markets.

4.6. The Day-Ahead (Spot) Market

The main issue in the WEM is that of pricing and the associated offers. This is the subject of Section 5. The following points cover certain other specific requirements for Phase 1 implementation.

4.6.1. Obligations to make offers

The move towards competitive based price offers envisaged for Phase 1 should provide an incentive for Generators to make offers whenever they have capacity available. However, there is a concern that, because the market is still far from competitive, market power may be a problem. For example, Generators could withhold capacity in order to reduce the availability margin and thereby enhance capacity payments. Also, the one-sided nature of the WEM means that there is insufficient demand-side participation to mitigate the market power of the Generators.

It is therefore necessary to specifically obligate Generators, by way of a license condition, to make offers whenever plant is technically capable of generating. This will require regulation to ensure that genuine reasons are given for any unavailability of plant. It is important that this regulation should not be bureaucratic or overly intrusive.

4.6.2. Mothballed plant

In a competitive market, Generators may find that, from time to time, it is uneconomic to operate certain power plants because the costs exceed the revenue obtainable from the wholesale prices. This is quite normal in a competitive market, simply indicative of the ups and downs of economic cycles. In such markets, it is usual for Generators to temporarily retire or "mothball" plant that is not capable of covering its costs. Generators have to declare the relevant plant capacity as being technically unavailable for this reason, so the expectation

is that the plant could only be brought back to operate by the time required to perform the necessary maintenance. This would normally involve a significant lead time between the decision to bring back plant from a "mothballed" condition to being operational.

4.6.3. Demand-Side Participation

Despite the fact that the WEM is essentially a one-sided market, there is no reason why a limited amount of demand-side participation by large customers should not be encouraged. This could provide a significant contribution to the overall capacity optimization. There would be minimal operational or systems requirements to enable such an enhancement. The simplest method is to allow designated large customers to bid their demand reduction as pseudo generation, with an appropriate price at which they are willing to actually reduce their load by that amount. Thus, the demand reduction is included in the stack order to set SMP, thus potentially reducing SMP. Also, it can be taken into account in calculating the availability margin and reserve requirements. The customers providing such a service could be rewarded by the payment of the Capacity Price for the demand reduction bids. This system operated successfully for many years in the England & Wales Pool and provided a limited but significant degree of demand side participation by a number of large customers. In the UK, demand management from demand side bids and other incentives, resulted in reducing the peak demand by over 2000 MW.

4.6.4. Reserve

The WEM Market Rules already incorporate payments for reserve operation, when scheduled to provide reserve by the system operator. Thus, for Phase 1, there is no requirement for additional market functionality, other than the above requirement that Generators should make plant available when technically available. NEK Ukrenergo has the responsibility to manage the system security and reliability, involving scheduling the appropriate amount of reserve from the plant that is available.

Discussions with NEK Ukrenergo support the view that this responsibility is properly managed, according to generally accepted standards of reliability and security. However, it would be beneficial for these standards to be more transparent, so that market participants and other interested parties could be aware of the principles adopted by NEK Ukrenergo.

4.7. Data and Metering for Settlement

Extract from "Strategic Direction" document:
"There will be step-by-step automation of the metering and data exchange system initially based on current hard and software, then equipment of metering points with hourly meters and automated communication systems, then improvement of processing software, then improvement of accuracy of metering systems. Protocols for data exchange should be carefully developed and made obligatory to follow by all parties participating in the process of data exchange."

The above stages indicate that significant improvements are required for full implementation of the settlement system. Some of these will be crucial to the proper working of the WEM (e.g. having hourly commercial quality meters at all grid connections). These requirements will be limiting factors in the practical timetable for implementation of Phase 1.

The importance of properly managing the data system improvements should not be underestimated. Experience in other markets (e.g. the implementation of the new settlements system in the UK for full retail competition in 1998) has shown that a detailed specification of the technical requirements is essential. This is especially true where responsibilities for implementation are split among various participants.

4.8. The Contract market

In the context of a competitive wholesale spot market, a contract market is essential, in order that market participants can manage their trading risks. In the context of a highly regulated market, which would apply in Phase 1, the need for financial contracts is not so essential. This is because Generators' revenue would still be largely regulated (nuclear and hydro directly and thermal by the regulation to make offers cost-based, as discussed in Section 5.1.1). Also, Suppliers' costs are prevented from rising to extreme values by the regulation of Generators' prices. Plus, they have the ability to pass through these costs. However, despite this, there is merit in implementing a contract market during Phase 1 for the following reasons:

- There will still be significant uncertainty, for thermal and CHP Generators, as well as for Suppliers, in the level and variation of SMP.
- Phase 1 is an opportunity to get used trading in the contract market, which will be an absolute necessity in Phase 2.
- Any level of liberalization during Phase 1, for example by allowing a degree of retail competition, would benefit from the existence of a contract market.

In order to ensure that a contract market actually takes off, it is desirable for some initial, regulated contracts to be established by NERC. These contracts would be for agreed amounts of MW[4]. They are likely to require "sculpting" (Appendix 3 provides an explanation of the need for this) to approximately match the load shapes of Generators/Suppliers. The initial contracts should be established for less than the full amount of power that will be offered in the WEM, to avoid distortion of the WEM by the contracts.

In addition to using contracts for the thermal plant, contracts would be a useful way to ensure that the regulated nuclear and hydro plant is available on a fair basis to all. Either:

- Nuclear and hydro plant could be specifically precluded from the contract market, thus ensuring that the only access to the benefits of the low prices is via the WEM pool price, which would be an average price of SMP and regulated purchase prices; or
- Contracts for nuclear and hydro plant could be rationed among all potential purchasers, including Suppliers and eligible customers. Rationing would need to be on the basis of energy supplied, or possibly on the basis of capacity served. One method would be to specify that a maximum of x% of each Supplier's energy could be obtained by nuclear contracts and y% from hydro contracts. The percentages would be set to reflect the relative proportion of total energy supplied from nuclear and hydro plant accordingly.

[4] Although the contracts would not be contracts for sale of power, they need to state the amount, both in price and MW terms, by which the contracts will offset the pool prices.

5. Generation Pricing in the WEM

In the November 2001 Report, it was identified that one of the main shortcomings of the current operation of the WEM is that Generators' offer prices are not representative of those that would apply in a competitive market. While on the one hand the generation sector in Ukraine is far from competitive, leading to potential market power abuse, there is excessive regulatory intervention in the market through the practice of regulating generation prices below cost.

In that Report, it was recommended that Generators' offer prices should be based as far as possible on competitive pricing, subject to regulatory oversight to prevent market power abuse. Detailed price regulation of Generators' offer prices was not recommended, since that involves intrusive regulation. Instead, it was proposed that a pool price cap should be set, at such a value as to prevent extremely high pool prices but not so as to cause offer prices to be below cost.

Price caps, when used only to prevent extreme price levels being encountered, offer a reasonable solution to an imperfect market. The use of such caps is consistent with the overall level of wholesale prices providing adequate revenue for Generators.

The current discussions indicate the strong desire to retain regulated generation prices, at least for the hydro and nuclear plant. The reason for this is that hydro and nuclear plant is still perceived as being "cheap" and, as a consequence, considered to be necessary to limit the revenue that such plant should receive, in order to keep wholesale prices down. This rationale, although well intentioned, is flawed. First, the economic cost of hydro and nuclear plant is not cheap. The capital costs involved in the initial construction and, more importantly, in the on-going refurbishment of such plant is high. The plant appears to be cheap because much of the capital cost has been written down. Second, hydro plant is operated as so as to meet the changes in demand pattern and specifically to meet peak demand. This means that, for most of the time, the use of hydro has the effect of avoiding the use of thermal plant, which would otherwise be needed to meet demand. Thus, the economic value of hydro plant is the opportunity cost of the marginal cost of thermal plant. Limiting the revenue that hydro and nuclear plant receives through regulated prices may, ceteris paribus, have the effect of lowering wholesale prices. However, it also results in a distorted market, since there is a preference, on the part of buyers, to maximize their purchase of cheap power. Also, in the long run, since the source of this cheap power is limited and, as demand increases over time, wholesale prices in future are subject to a significant increase. Furthermore, as wholesale prices are currently held below cost, this is likely to lead to a higher demand than would exist if prices reflected proper economic costs.

However, the reality appears to be that regulated prices for hydro and nuclear plant are a necessary feature and must therefore be accommodated within Phase 1. It is for consideration, therefore, how best to achieve this requirement, while at the same time:

- Avoiding any distorting affect on the calculation of SMP; and
- Avoiding any distortion to the stack order of generation plant, thus preserving economically efficient dispatch and minimizing overall generation costs.

The subsequent analysis discusses the differences that would result from retaining regulated prices for nuclear and hydro plant, as opposed to allowing these Generators to offer their plant into the WEM in the same way as thermal Generators.

5.1. Revenue from the WEM

5.1.1. System Marginal Price and Generation offer prices

The WEM uses the concept of System Marginal Price (SMP), as the basis for pricing the exchange of power in the (day-ahead) spot market. This concept is soundly based and is widely adopted as a pricing principle in wholesale electricity markets. The general principle is that all power, within a defined Trading Period (1 hour in the WEM), is priced at SMP. The level of SMP, for each trading Period, is derived from the most expensive unit of power offered in the day-ahead market for that particular Trading Period[5]. Thus, it is necessary that all generation plant should provide an offer price associated with its ability and willingness to generate a declared amount of power. The offers to generate produce a "stack order" of power for each Trading Period, i.e. the cumulative amounts offered, stacked in ascending order of price.

For the wholesale market to operate efficiently, it is important that:

- Generation offer prices reflect the market conditions – in a competitive market, offer prices are determined primarily by the economic forces of supply and demand. In a regulated market, the price offers need to take cognizance of the regulation requirements.
- Plant is dispatched in economic (stack) order, i.e. on the basis of the price offers. Any dispatch that deviates from this principle will add to the overall costs of generation. However, it is necessary to deviate from the stack order in order to accommodate system constraints[6].

The consequence of using SMP as a pricing basis is that most Generators actually dispatched will earn SMP revenue in excess of their offered prices. In fact, it is only the marginal plant at any time that will only receive its offer price. The amount of surplus revenue earned from SMP (i.e. in excess of offer price) depends on the shape of the price curve and the proportion of time that any particular plant is operating. If a system has an economically optimal mix of plant types to meet the changing shape of demand over a whole year, the revenue earned from SMP is sufficient to remunerate most types of plant. That is, the SMP revenue would cover both its variable costs and its fixed (capital) costs[7].

The average level of SMP for most of the year 2001 was around 12 kopec/kWh during daytime hours and around 10 kopec/kWh at night. These levels applied from January through September, when a price cap of 123 UAH/MWh (i.e. 12.3 kopec/kWh) was set by NERC. For the months of October through December, SMP levels fell to around 10 kopec/kWh in the daytime and 7 kopec/kWh at night. In these months, the SMP price cap was set at 10.4 kopec/kWh.

This indicates that the NERC price cap applied to SMP is effectively setting the SMP level during the daytime hours. This is a consequence of having price caps that are close to the expected level of SMP, which is not a sensible way to regulate prices in the wholesale market. Given that regulation requires Generators to submit offers that reflect marginal (i.e. avoidable) costs, there should be no reason to set a price cap at the average SMP level.

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[5] The WEM Market Rules specify that only flexible plant can set SMP.

[6] The WEM Market Rules make specific provision for such deviations, including the mechanisms for payments to Generators in such circumstances and for applying the costs to purchasers.

[7] See Appendix 2 of the previous report – "Recommendations concerning possible changes to the Ukrainian Wholesale Electricity Market".

Instead, it would be better to set the price cap at a significantly higher level than average SMP, in order to prevent excessively high prices occurring at peak times.

The need to retain price regulation for nuclear and hydro plant mean that all such plant will not contribute to setting SMP nor will it receive SMP. The impact on SMP and the implications for Phase 1 are discussed in the relevant sections below, in respect of each of the three main types of plant, i.e. thermal, nuclear and hydro. There are also consequences for the determination of the Capacity Price.

5.1.2. Capacity Price Mechanism

In addition to SMP, the WEM Market Rules also provide for payment of a Capacity Price in each Trading Period, paid according to the capacity of each generating unit actually offered to the market. The Capacity Price (CP) is expressed as a price per MW of plant capacity. It is paid on an hourly basis and added to SMP (as a price per MWh) to produce the Pool Purchase Price (PPP), which is the basis for remuneration of thermal plant and for payments by purchasers (Suppliers). The rationale for a Capacity Price is not as clear as SMP. It was a feature of the pricing structure in the England & Wales Pool (now replaced by a balancing market – NETA) and the Argentina wholesale market (CAMMESA) also uses a Capacity Price. The idea behind the Capacity Price mechanism is to reward Generators for providing capacity separately from the provision of energy. However, since Generators earn revenue from SMP in excess of their offer prices, the Capacity Price element has to be limited to the extent to which revenue from SMP may not provide sufficient revenue to ensure that supply and demand balance. In the case of Ukraine's WEM, as in Argentina, this is a calculated price.

In the Ukrainian market, the Capacity Price is a regulated price, set by NERC. For each trading Period, the Market Operator calculates the availability margin, i.e. the difference between the total amount of capacity offered and the forecast total demand. The Capacity price for any particular Trading Period is determined by a formula, which is also set by NERC. Currently, the formula specifies that when the availability margin is at or below 1000 MW, the full value of the Capacity Price will be paid. When the availability margin is at or above 2000 MW, the Capacity Price falls to zero. Between 1000 MW and 2000 MW, a linear proportion of the full price applies. The Capacity Price is paid to each Generator offering capacity for that Trading Period.

The recommendations contained in the November 2001 Report were that NERC should determine the Capacity Price with reference to the estimated SMP revenue earnings for each type of generating plant, such as to appropriately reward each type of plant in total. This would have meant that the Capacity Price would be an administered price, separately determined for each type of plant, so as to produce the appropriate amount of overall pool revenue for each type of plant. (In the case of hydro plant the Capacity Price might be negative).

However, now that it is necessary to retain regulated pricing for nuclear and hydro plant, the Capacity Price concept has a somewhat more limited value. Given that Phase 1 is expected to operate for a period of only 2-3 years, it is not reasonable to expect that the Capacity Price will provide any incentive for investment in plant capacity in the longer term. The most that it could do is to provide an incentive, in addition to that provided by SMP, for existing plant to be made available by way of making offers to the WEM.

Even if Phase 1 continued beyond the current expected time horizon, the Capacity Price would not provide an incentive for long-term capacity investment, unless it is made clear that

the Capacity Price is to be an on-going feature of Phase 2. This is not recommended, however, because Phase 2 is intended as a better design than Phase 1 and therefore would not involve the use of artificial constructions such as the Capacity Price.

It is therefore suggested that the Capacity Price should continue to be set by NERC and used in Phase 1 of the WEM as follows:

- The Capacity Price should be based on a pre-determined value, set by NERC, for each monthly period and published [three] months in advance. *[actual length of notice to be set to provide a reasonable incentive to make plant available within this period]*
- The Capacity Price could vary according to the expected variation, within the month, of the availability margin. However, by pre-publishing the levels for each trading period, this should encourage Generators to maximize their availability within these periods.
- The Capacity Price should be paid to all thermal Generators that make offers to the WEM during each month, on a retrospective basis (i.e. following the end of the relevant month), depending on the number of hours and the number of MW offered during that month. This would be without regard as to whether the plant was actually dispatched, scheduled to provide reserve or not scheduled during any Trading Period.
- Any plant that is subsequently found to have offered capacity without being technically available for generation would be required to refund the capacity payment, together with a penalty payment.

5.1.3. Capacity Price Level

The level of the Capacity Price should be set so as to provide a reasonable incentive, over and above that from SMP revenue, for making plant available. Setting the price on a monthly basis, together with appropriate variations between Trading Periods, would allow for temporal variations in the supply/demand balance and to ensure that payments can be tailored to reflect the need for maximum availability.

The method currently used in the WEM attempts to provide a direct incentive to enhance availability depending on the availability margin (i.e. difference between total amount of generation available and expected demand) in each Trading Period. This is the "Loss of Load Probability" (LOLP) approach that was used for the Capacity Price in the England & Wales Pool. However, the mechanisms used in the England & Wales Pool were complex and theoretically based. Experience from that market showed that the mechanism did not provide an incentive to maximize plant availability and was subject to significant exploitation of market power. It is therefore suggested that the simpler approach outlined above might be more effective.

Since it is an artificial component, there is no definitive reference point for setting the level of the Capacity Price. It is suggested that the existing level be retained as the basis for Phase 1 but that the price should be "sculpted" to reflect the need for greater availability in the peak months and peak hours. Following the implementation of Phase 1, NERC should monitor the effectiveness of the Capacity Price, as an incentive mechanism for making plant available. Depending on the outcome, NERC could raise or lower the price or alter the monthly and trading period differentials, to make the incentive more effective. However, there is the danger of market power being exercised by Generators and NERC should be vigilant to avoid market power abuse. This issue is discussed further in Section 6.1.

The current level of Capacity Price, at 150 UAH/kW, was introduced by NERC in March 2002, in conjunction with a revision of the levels of availability margin that trigger the payment level. It is thus too early to see the effect of the changes in terms of capacity offered

to the market. However, after the 2002/03 winter, it should be possible to compare a full year before and after the changes. A problem, though, is that the Capacity Price level was also changed during 2001, from 10 UAH/kW to 40 UAH/kW, in conjunction with a change to the price cap applied to SMP. It is an important principle to bear in mind that, in order to monitor the effects of regulated prices, there should be sufficient time for the effects to be observed.

The question continues to be posed as to what is the "right" level for a Capacity Price. There is no real answer to this question, since the use of a Capacity Price is an artificial construction and plays no part in wholesale electricity markets using competitive pricing. In the England & Wales Pool, the level of Capacity Price was linked theoretically to the "Value of Lost Load" (VOLL), i.e. the opportunity cost of forgoing power, via the Loss of Load Probability (LOLP) and the "Disappearance Ratio" of individual plant capacity. These items were linked by a complex formula using a number of artificial constants to arrive at an appropriate average level, theoretically supposed to be equivalent to the cost of providing the cheapest form of capacity on a thermal system[8], which is an open-cycle gas turbine. However, the artificial construction of this complex chain indicates the degree of invention, rather than incentive. Indeed, there was little effective incentive for short-term capacity maximization coupled with market power abuse of the pricing mechanism. Thus, it is not recommended that the WEM should attempt to follow this approach. Rather, accepting that the Capacity Price is administered, it should be used simply but effectively to provide an incentive for making capacity available.

An analysis of WEM prices for 2001[9] indicates that, for that year, the average level of the Capacity Price in October, November and December reached around 3.5 kopec/kWh during the daytime hours. During this period, the maximum level of the Capacity Price was at 40 UAH/kW. In the earlier months of 2001, the average daytime level reached 0.5 - 1.0 kopec/kW, when the maximum level of the Capacity Price was set at 10 UAH/kW. The analysis shows that the combined effect of changing the Capacity Price and the SMP cap was to leave overall pool prices at much the same level, as discussed in Section 5.1.5 below.

5.1.4. Flexibility Payment

Another change introduced recently is the addition of a Flexibility Payment, in addition to SMP and the Capacity Price. The idea is soundly based, in that it is intended to reward plant that is sufficiently flexible to meet short-term changes in output required to follow changes in the demand pattern. What is not clear, however, is how the level of payment was determined. It is likely that it is simply an administered amount, considered to be appropriate to provide a sufficient incentive. If so, that is fine but there should be an acceptance that such devices are subject to "trial and error". Consequently, as with the changes to the Capacity Price and SMP cap, there should be a properly monitored period to examine the effectiveness. Furthermore, the mechanisms and the monitoring should be part of a transparent process within the market. This is an example of the kind of practices, together with a change in culture, that need to be employed generally within the WEM to help to make genuine improvements.

5.1.5. Pool Purchase Price

Pool Purchase Price (PPP) is the sum of SMP and the Capacity Price. In 2001, the overall effect of the capped SMP and the administered Capacity Price was that average pool prices

[8] The Ukrainian system is very different in this respect from England & Wales, since Ukraine has significant hydropower to manage its peak demand.

[9] "Wholesale Electricity Market Prices in Ukraine", internal document produced by Hunton & Williams.

(i.e. SMP + Capacity Price) were consistently between 12 kopec/kWh and 14 kopec/kWh during the daytime. The following conclusions can be drawn from the data:

- The overall price levels are similar to international wholesale prices for electric power, indicating that pool prices should adequately reward thermal plant operating in Ukraine. For example, current average wholesale prices in England & Wales, which is almost entirely thermal and nuclear, vary from around 1.1 p/kWh in off-peak periods to around 2.5 p/kWh in peak periods. The overall average price in the England & Wales contract market is around 1.8 p/kWh. In the USA, wholesale prices in those areas that are predominantly thermal average around 3 US cents/kWh.
- Regulatory changes to the prices appear to have kept the overall pool price at much the same level, indicating unclear direction in the regulatory changes adopted.
- The consistency of the price levels, which has been achieved by regulatory pricing, suggest that there is a lack of market incentive to ensure that only the most efficient plant is used to meet the demand. Otherwise, we would expect to observe a greater variation in wholesale prices, reflecting competition at the margin as the more efficient Generators cause the less efficient ones not to be included in the schedule.

With regard to last the above points, the general conclusion is that the market mechanism is largely ineffective and prices are determined primarily by regulation. If that is intended to be so, it seems to be superfluous to have a market mechanism at all. Instead, the Market Operator could simply dispatch plant according to regulated marginal costs and apply a simply administered price. The price could be two-part (capacity and energy) or three-part (i.e. including a flexibility component). This way, at least it would be clear that it is an administered pricing system rather than pretence at a market mechanism. On the other hand, if there is to be a genuine attempt at reform in the Ukrainian power market, wholesale prices have to be allowed to progress towards something resembling market prices. This does not mean that wholesale prices necessarily have to increase, since it is clear that current price levels for thermal plant are already around international price levels. Rather, it means that greater variation (and therefore uncertainty) has to be allowed, in order to achieve the benefits of competitive bidding into the WEM.

Phase 1 should therefore move away from the current method of over-regulation of prices towards a system where the wholesale prices are, at least in part, determined by actions of the market participants rather than simply the regulator.

5.2. Thermal Plant

It has been suggested that direct regulatory control of prices should continue to apply for the hydro and, possibly also to the nuclear plant. This would leave only the thermal plant to operate within the market.

In general, prices for generation should not be directly regulated. If generation prices are fully regulated, there is little point in having a day-ahead market and it would be simpler to operate as a Single Buyer Market with a Bulk Supply Tariff (BST) as the basis for sale and purchase.

It is therefore suggested that the thermal Generators should be allowed to operate, as far as possible, in a competitive environment. In other words, thermal Generators become the commercially marginal plants, competing to gain access to the day-ahead market by competitive offers. This is somewhat of an ideal situation, however and there are certain realities to contend with, namely:

- The need to prevent Generators from exerting undue market power in making their offers, particularly by preventing the withholding of capacity.
- In situations where there may be insufficient plant (of all types) to meet the expected demand, there is a need to prevent Generators from exploiting this situation by making offers at excessive prices.

To some extent, the above two issues are linked, since by preventing artificial withholding of capacity, this should lead to maximizing the plant availability. In addition, operation of the Capacity Price as an incentive mechanism, as described above, should help to improve availability. However, there may still be occasions when potential demand exceeds supply.

When this occurs, there are two possible solutions. One approach is to allow the wholesale price to find a level at which sufficient demand price response takes effect, i.e. price discovery. However, this is likely to be at a very high level of prices if the market were to be completely unregulated. The other approach is to restrict the wholesale price, either by restricting the price offers from Generators to be reflective of actual costs or by imposing a pool price cap. It would not be appropriate to adopt both a pool price cap and a requirement to reflect actual costs, since this would mean either that the price cap was too low (i.e. some plant not covering its costs) or that the price cap was never reached.

The wholesale market in Ukraine is insufficiently competitive to allow full market driven pricing. If the wholesale price level were to be completely unchecked, severe price spikes would be likely to occur, due to capacity shortages and the lack of adequate demand response to price spikes. However, it is suggested that the use of a pool price cap is not the best way to deal with the situation. Rather, it is suggested that, for Phase 1, the most appropriate approach would be to adopt the principle that offer prices should reflect the marginal costs of plant operation, including start-up, no-load costs and generation costs. In the case of fuel costs, this should include the cost of gas used by coal plant, where this is used for reasons of fuel quality. Thus, all thermal plant would always cover its marginal cost and most plant would receive a contribution towards its fixed costs by way of the SMP payments and the Capacity Price.

Regulation of the offer prices should be as un-intrusive as possible. It is suggested that NERC should carry out a random sample audit of Generators' offer prices, with the treat of payment penalties should it be found that offer prices have materially exceeded costs.

The market analysis, carried out by Hunton & Williams, suggests that the fuel cost of thermal plant is within the range 1.4 to 2.1 US cents/kWh (7.4 to 11.1 kopec/kWh[10]). In addition to fuel costs, there are the non-fuel marginal costs and the costs associated with start-up and no-load operation. It would be useful to analyze these costs and compare with the actual pool prices that currently obtain.

Actual pool prices for 2001 (monthly averages for each hour in kopec/kWh) are as follows:

Month	SMP – min.	SMP – max.	PPP – min.	PPP – max.
January	9.13	12.59	9.13	13.59
February	8.82	12.39	8.82	13.39
March	8.95	12.14	8.95	13.14
April	9.6	12.16	9.6	13.16
May	9.99	12.82	9.99	13.82

[10] Based on exchange rate of 1 US$ = 5.276 UAH.

Month	SMP – min.	SMP – max.	PPP – min.	PPP – max.
June	9.26	12.12	9.26	13.12
July	9.01	12.24	9.01	13.24
August	9.08	12.05	9.08	13.05
September	9.5	12.05	9.5	13.05
October	6.66	10.39	6.66	14.39
November	6.58	10.45	6.58	14.45
December	7.61	10.22	7.61	14.11

As already observed, the overall pool prices in Ukraine are close to those experienced in other markets, suggesting that the prices should be sufficient to cover marginal costs (mainly fuel) as well as providing a contribution towards the fixed (capacity-related) costs. However, the mix between the Capacity Price and SMP, within the overall pool price, is currently determined by regulation. This is a necessity, since the Capacity Price is an artificial component, as observed from the apparently arbitrary determination of the level of the Capacity Price and the recent significant changes.

As explained in Section 5.1.1, Generators that are actually dispatched will generally earn revenue from SMP in excess of their offer prices. If we assume that their offer prices reflect their marginal cost, this means that there is a contribution, within SMP, towards the fixed costs. For pool prices to cover generation costs fully, the Capacity Price needs only to provide the further amount, above that provided from SMP, to cover the fixed costs.

Suppose, for example, that a thermal power plant operates at 70% load factor at a marginal cost of 7 kopec/kWh. If the annual average SMP is 10 kopec/kWh, the plant will earn an annual SMP revenue, in excess of its marginal cost, of 3 kopec/kWh, which is equivalent to an annual revenue of UAH 184/kW[11]. If the capital cost of the thermal plant is annualized at, say, UAH 400/kW/year, the Capacity Price would need to be at a level of UAH 216/kW (i.e. the difference between 400 and 184) in order to fully cover the capital cost.

It would be possible to set a different level of Capacity Price for each type of generation plant, so that, for each type of plant, the combination of SMP and the Capacity Price provided the required amount to cover both marginal and fixed costs. A simple model, such as the one developed by Hunton & Williams, could provide the analysis for such a determination. However, it has to be stressed that this would simply be a mechanism for providing a required amount of revenue for Generators. This is not what the idea of a competitive wholesale market is about.

5.3. Nuclear Plant

Nuclear plant is generally inflexible and so would not set SMP in any case, even if it was included in the price stack. It is important, however, that the full contribution of the nuclear plant is included in the plant schedule by the Commitment Software, so as to ascertain correctly the marginal (thermal) plant.

It is understood that the existing price regulation of nuclear plant has to continue. The implication of this, for the rest of the market, is that prices generally will be held artificially low, on the basis that the regulated prices for nuclear plant do not reflect the full economic costs of nuclear plant. Consequently, wholesale and retail prices are lower than would

[11] 70% load factor = 6132 hours of operation. The 3 kopec/kWh surplus, above marginal cost, for 6132 hours, equals UAH 184/kW.

otherwise obtain, which has the effect of increasing demand and reducing the incentive to construct new generating capacity.

The incentive for the availability of nuclear plant to be maximized is that Energoatom will maximize its income by maximizing its output. However, unless specific further incentives are inherent in the system, this does not ensure that Energoatom will maximize the availability of its plant when it best suits the market, rather than when it suits Energoatom to do so.

5.3.1. Effects of allowing nuclear plant to make commercial offers

The above analysis assumes that nuclear plant continues to be price regulated. The question has been asked – "What if Energoatom were to be allowed to make offers into the WEM?" In answer to this question, it is assumed that this would involve nuclear plant being offered into the WEM but still be subject to regulated prices.

First, it is very important that, regardless of how Energoatom's revenue is regulated, the calculation of both SMP and the stack order are not distorted. That is why, in Section 5.3 above, it is stressed that all plant should be used in the preparation of the stack order. Otherwise, the stack order will be incorrect and inefficient, leading to more expensive plant being scheduled. It is understood that this is what can already happen now, during low demand periods.

Therefore, regardless of whether Energoatom is "allowed" to offer or not, it is essential that the WEM "sees" an economically correct price signal from nuclear plant. This means that the nuclear plant should be included in the price stack at zero cost (or near-zero) since this is the true marginal cost. Only then will a correct stack order result. If demand is so low that nuclear plant is actually at the margin, SMP would be set according to the existing Market Rules that allow for such a situation.

Thus, the only real difference is between allowing Energoatom to make real offers, or assuming the offers to be at zero. In both cases, the plant should be included in the price stack. It is likely that Energoatom would in fact offer its plant at near-zero prices anyway, since this would be the best strategy to adopt for base load plant that is not expected to set SMP.

The difference in revenue terms for Energoatom, however, is that, on the one hand (regulated) it would receive regulated prices, while on the other hand (unregulated) it would receive SMP and the Capacity Price. As explained in 5.1.2, it is possible to set different values of the Capacity Price for different types of plant. Thus it would be possible to estimate, in advance, the revenue that would be earned from SMP + Capacity Price, for say, a full year. This revenue could be compared with the revenue from regulated prices for the same volume of generation. It would then be possible to set the Capacity Price (nuclear) at a level that equated the two revenue calculations. This would mean that Energoatom could be "allowed" to offer and at the same time, effectively control its revenue. However, this would only really be suitable if the resulting Capacity Price (for nuclear) was still a positive value. If the value was negative (i.e. revenue from SMP exceeds the regulated revenue), it would not be suitable because the whole point of the Capacity Price is to provide an incentive to make plant available. A negative price would provide an incentive to do just the opposite.

So, the preferred method is:

- Nuclear plant to be subject to the obligation to declare available capacity, just as thermal plant.
- Nuclear plant to be included in the price stack at an assumed zero price.
- Nuclear plant to receive a regulated price for all actual generation, however;
- This regulated price should be the existing regulated price (or whatever level is deemed appropriate) less an estimated average value for the Capacity Price that nuclear plant would receive if it were allowed to offer capacity in the same way as thermal plant. It would be necessary to establish some "target availability" for the nuclear plant, over an annual basis, for this to be calculated.

The advantage of this approach is that the nuclear plant would still have an incentive to maximize availability and be paid for actual availability just like thermal plant. However, most of its revenue, apart from the Capacity Price, would be completely regulated. The Capacity Price element would provide a small amount of incentive for Energoatom do achieve better than the "target availability" set for nuclear plant. Any extra revenue paid as a result would be more than covered by the higher availability.

5.4. Hydro Plant

With regard to the requirement for regulated prices, similar considerations apply to hydro as to the nuclear plant. The additional dimension with hydro, however, is that this type of plant is used mainly as peaking plant. It therefore occupies a key strategic position in the market, although only supplying around 9% of the total generation. Hydro generation in Ukraine is viewed as "cheap" power, whereas generally the economics of hydro generation, when construction costs are included, often result in the costs of hydro generation being close to, or even higher than, thermal generation. However, since hydropower is extremely flexible with very rapid response times, it is highly valuable to the power market.

Given the constraint that prices for hydro generation are to remain regulated at low price levels, there is no scope for a true reflection of the economic value of this plant in the market. However, it is relevant to consider the mechanism for rewarding the hydro Generators, within the context of a low regulated price. The most appropriate form of financial arrangement would be a contracted basis, so that the hydro Generators are paid to provide a contracted amount of hydro capacity to the WEM, subject to certain constraints regarding the uncertainty of water inflows and other water uses, such as irrigation. Contracts would therefore be on the basis of MW of capacity, rather than MWh of energy supplied. Thus, the WEM would have a call on this capacity, subject to the aforementioned constraints, at times determined by the Market Operator. To use this capacity most efficiently, the Market Operator would need to have a thermal/hydro optimization routine within its scheduling and dispatch process.

It is understood, from discussions with relevant personnel, that there is no requirement for hydro/thermal optimization because government currently determines the water resources available for power generation. While it is accepted that this is a policy matter, it still seems unlikely that there could not be some further improvement in the day-to-day utilization of water resources, possibly by considering power and non-power requirements.

5.5. CHP and other Generators

There is no a priori reason why CHP or other types of generation should not be treated in the same way as the thermal plant. Generally, CHP generation is less responsive to the market requirements, since its prime concern is usually to meet the demand of the heat requirements. It may therefore operate as inflexible plant, not participating in setting SMP but receiving SMP and Capacity Price as payments for generation.

CHP and other plant provide around 9% of the total generation. It is therefore assumed that these Generators would not be able to exert market power in any significant manner. Therefore, there does not appear to be any particular reason for regulating these prices. If these Generators can supply power cheaper then the thermal Generators, they should be allowed to do so and under-cut the thermal price offers. If they cannot compete with the regulated thermal prices, they would not appear to have any value to the market.

5.6. Supplier Costs

The effects on Supplier costs of the pricing mechanisms envisaged for Phase 1 are:

- Due to the artificially low regulated prices for nuclear and hydro plant, wholesale and retail prices will be lower than would otherwise obtain.
- No incentive mechanism exists for Suppliers to minimize their purchase costs, so long as they can recover these costs via their retail tariffs. However, the ability to recover costs is highly dependent on the amount of cash that is collectable from customers.
- The need to regulate Suppliers costs, by way of an economic purchasing obligation, would still exist.
- All Suppliers should have fair and equal access to the low regulated prices of the nuclear and hydro plant. Under a pooling arrangement, this would automatically apply. However, any arrangement that allowed direct access to these prices, other than through the WEM, during Phase 1, would require careful control to ensure equity of treatment between all Suppliers.

5.7. Demand and Supply

One of the main advantages of the reforms to be implemented in Phase 1 is that the thermal Generators should have sufficient incentive to offer to generate at all times when they have capacity available. This is because revenue from SMP would cover their marginal costs, as well as providing a contribution to fixed costs. The obligation to offer capacity is necessary only to prevent any potential market power abuse. Thus, as far as the thermal plant is concerned, the only distortion to normal market forces is that the price offers are to be regulated to reflect costs, rather than be allowed to reach a market clearing price. This, however, is a necessary restriction, due to the potential for market power and because of the lack of full demand-side participation in the wholesale market.

However, the effects of the requirement to retain regulated prices for nuclear and hydro plant on supply and demand are as follows:

- As a result of the Supplier prices, overall, being lower than might obtain under a competitive market, retail prices will also be lower, which is likely to have the effect of increasing demand, thus exacerbating any existing capacity shortage.
- In addition, due to low wholesale prices, there will be a reduced incentive to construct new generating capacity. However, since current wholesale price levels are close to international prices, there should be no such disincentive, at least for economic reasons.

5.8. Retail Tariffs

The effects on retail tariffs of the pricing mechanisms envisaged for Phase 1 are:

- Tariff regulation is assumed to continue to operate on the basis of the full cost pass-through. Full cost pass-through of purchase costs would include both the costs of buying from the WEM and any additional costs associated with the financial contracts. The costs

of the financial contracts, being contracts for differences, could be either positive or negative.

- Retail tariffs would continue to contain an element of subsidy, due to the low regulated prices for nuclear and hydro plant.

5.9. Scheduling and Dispatch

Implementation of Phase 1 will require NEK Ukrenergo to operate scheduling and dispatch according to the stack order determined by the Market Rules. Essentially, this means that the schedule will be set by the price and capacity offers from thermal and other generating plant, taking into account system constraints.

NEK Ukrenergo is responsible for managing the integrity of the grid and thus will determine:

- What system constraints apply in each Trading Period; and
- How much reserve to hold, in appropriate categories of reserve, at all times.

Management of the grid will, to some extent, be prescribed in the Market Rules and the Grid Code. In particular, the principles for holding reserve to manage system frequency should be clearly defined. The Grid Code obligates Generators to provide the necessary Ancillary Services required by NEK Ukrenergo to manage system frequency and voltage, including the requirement to provide reactive power as applicable to each generating unit. Where additional Ancillary Services are required, over and above those that are obligatory under the Grid Code, NEK Ukrenergo will need to procure the necessary services by competitive tender. The guiding principle should be transparency of operations of NEK Ukrenergo, in order to ensure confidence and to maximize efficiency.

Constraint management by NEK Ukrenergo could be made more transparent by a separate production of an unconstrained schedule, in addition to the actual constrained schedule. It would then be possible, by comparison of the two schedules, to determine the cost of system constraints. This would be useful information for NERC to monitor the efficiency of NEK Ukrenergo and to indicate where there may be opportunities for constraint relief by new generation or transmission capacity.

During discussions with the Market Operator, it appears that currently the Commitment Software utilized for determining SMP is based on an ex-ante, rather than ex-post definition of SMP. This is recognized as being out of line with the Market Rules but not considered to make any material difference to the result. Since the determination of SMP is so highly influenced by regulation, this is no surprise but the situation might be different if SMP were to be market based. This is because a market based SMP is likely to be significantly more variable than the current SMP and so any differences between the ex-ante and ex-post levels could be higher.

Accommodating the continued regulated prices for nuclear and hydro plant, will require no particular special treatment as far as scheduling and dispatch is concerned. Thus, the regulated prices could be submitted as the price "offers" for such plant. The only potential problem with the nuclear plant offers is if the regulated prices were to exceed SMP. A solution to this potential problem is for nuclear plant to offer a zero price at all times. Since nuclear plant will never be the marginal plant, it would not affect SMP. This would ensure that nuclear plant, when offered, is always dispatched.

There is a different problem with hydro plant, since the hydro plant operates as peak load, rather than base load, as well as providing the main source of spinning reserve. The problem

is to ensure that the hydro plant is optimally scheduled and dispatched, in order to minimize overall generation costs, while maintaining adequate system reliability. In a competitive market, optimality would depend on market forces. In the regulated Ukrainian market, it is necessary to adopt a different approach. It is suggested that the most appropriate method would be for NEK Ukrenergo to have a specific license obligation to use hydro generation in such a way as to minimize overall generation costs, subject to maintaining the required level of system reliability. How it does this would be up to NEK Ukrenergo but it is expected that it would utilize a hydro/thermal optimization system[12].

Scheduling the pumped storage plant would be similar to normal hydro but, in addition, it is necessary to ensure that pumping operation occurs at times of lowest SMP, in order to minimize the cost of pumping.

[12] The usual approach is to calculate a value of water in storage, for each storage system, according to the opportunity cost of thermal generation and the level of storage remaining in the particular reservoir system. This requires a probabilistic solution.

6. Market Monitoring and Compliance

The WEM during Phase 1 will remain a highly regulated market, requiring significant regulatory oversight. This will demand a carefully balanced role for NERC, in order to ensure that the market operates efficiently, while at the same time avoiding bureaucratic regulation. Ensuring compliance by effective incentives and penalties should be preferred mechanisms for efficient regulation. NERC will therefore have to carry out specific monitoring of various operations of the WEM to determine that the market is indeed operating effectively and have appropriate remedies to take action when necessary.

6.1. Generation Offers and Plant Availability

As discussed in Section 5.1.1, there will be a requirement to monitor the price offers of thermal Generators, to ensure that the offers are reflective of marginal costs. However, it is most important that regulation of the offer prices should be as un-intrusive as possible. It is suggested that NERC should carry out a random sample audit of Generators' offer prices, with the threat of payment penalties should it be found that offer prices have materially exceeded costs.

In addition to monitoring the offer prices, the plant availability declared by Generators will also require to be monitored. Again, however, this should not be overly intrusive or bureaucratic. A random check, with appropriate penalties for abuse, would be one method of ensuring compliance.

6.2. Plant Dispatch

Regulatory monitoring of scheduling and dispatch is important for two reasons:

- To ensure that plant is scheduled and dispatched, according to the Market Rules and in the most effective manner; and
- To ensure that prices are determined in accordance with the Market Rules, so that the resulting prices are known to have been determined correctly.

At one level, monitoring of scheduling and dispatch could be part of an on-going sample audit of the processes involved in determining prices in accordance with Market Rules. However, this approach is likely to result in a considerable delay in detecting any problems.

Another approach, therefore, is for NERC to carry out some very simple modeling of the processes in order to produce its own version of a price stack and SMP. To do this, NERC would require access to an appropriate model. However, in order to monitor the average levels of SMP, rather the details, it might be sufficient to utilize a simple stacking model like the one produced by Hunton & Williams[13]. This model, while not capable of determining SMP in the same detail as the Commitment Software, provides a good guide as to the relative position of each plant based on costs and could also produce an average SMP level for any level of demand. It is therefore recommended that this approach should be discussed with NERC.

Additionally, NERC could request that the Market Operator conduct certain specimen runs of the Commitment Software. These could be specified, by NERC, to reflect average or extreme conditions, so that NERC could examine the impact of particular circumstances. NERC might also use this approach to test the impact of proposed changes to the pricing system.

[13] As described in "Modeling of the Stack Order for Economic Dispatch of the Thermal Power Units in the Ukrainian Wholesale Electricity Market" – internal Hunton & Williams document.

6.3. Generation Market Share

In a competitive market, market share is indicative of the effectiveness of competition. If one or more Generators hold too great a share, it may indicate a need for regulation to improve competition. However, this is not relevant for Phase 1, since the market is still highly regulated.

However, what is highly relevant to Phase 1 is that certain Generators might dominate the setting of SMP, thus having an unduly large impact on the market. This kind of behavior was observed in last few years of the England & Wales Pool, despite the fact that, by then, market share of generators had been reduced significantly.

It is relatively easy for NERC to monitor SMP setting of individual plant or Generator, since it already possible to examine which particular power plant sets SMP in each Trading Period. To make such monitoring more effective, it is suggested that NERC could request a specific analysis from the Market Operator, with the objective of monitoring the proportion of the time that each plant and Generator sets SMP.

The purpose of market monitoring by NERC is so that it can take the appropriate action to improve the performance of the market. If it was found that one or two Generators dominated the setting of SMP, one response would be to require some of the plant owned by those Generators to be divested, to improve the competitiveness of the market.

6.4. Performance Monitoring

One of the main regulatory methods used by utility regulators is to measure the performance of the regulated utilities against relevant standards. This is effective at several levels. First, by measuring and publishing a "league table" of performance results, companies are naturally encouraged to avoid being a poor position. Second, the performance measurements can be directly linked to regulatory payments, for example Capacity Payments. For example, a poor performance in terms of a Generator making its plant available could be penalized by reducing the Capacity Price payable in respect of that plant. Third, measurement of performance provides a basis for benchmarking utilities against international or other comparative standards. For example, international comparisons of plant availability could provide a benchmarking opportunity.

It is recommended that NERC should be encouraged to set relevant performance standards for the regulated energy utilities, including, where appropriate, performance standards for the wholesale electricity market. The companies should then be measured against these standards and the results published. However, as with all other aspects of regulation, NERC should be encouraged to avoid the bureaucratic approach that is so frequently observed in its operations. Performance monitoring does not have to be overly intrusive.

6.5. Access to the Market

For a market to be successful, it should be relatively easy for potential new entrants to gain access to the market. NERC has a prime role in ensuring that access to the market, via the relevant license, is as straightforward as possible, consistent with maintaining the necessary requirements for technical and financial robustness.

6.5.1. Generators

For Generators, the main considerations are technical. In addition to a Generation License, other consents or permits may apply, particularly for certain types of generation plant.

Competition is likely to be enhanced by ensuring that all types of Generator, including small-scale CHP schemes, have free access to the market. New plant capacity is likely to be provided by new entrant generation and it is important that such new entrants are particularly encouraged. Part of this will involve the provision of a stable environment to trade their product. A competitive market, relative free from regulatory manipulation, is more likely to encourage new entrants than one in which regulation is highly intrusive.

It is important to understand that providing access to the market for new entrants is not discriminating against existing Generators. Rather, it is simply providing equal opportunities for existing and new Generators alike. Without access to the market by new entrants, the existing Generators are in fact enjoying positive discrimination by market protection, which is anti-competitive and leads to retention of higher costs.

6.5.2. Suppliers

Access to the market by Suppliers is mainly an issue for retail competition. Therefore, it is less important initially than access by Generators. However, as retail competition is enlarged to extend to further customers, it will be necessary to ensure that all Suppliers, including Oblenergos, have non-discriminatory access to the market. Part of this will involve non-discriminatory pricing for third party access to transmission and distribution networks.

6.6. Retail Competition

6.6.1. Rationale for Retail Competition

The main reason for enabling retail competition is to enable customers to be able to exercise choice of supplier. In doing so, they put competitive pressures on Suppliers, who in turn are forced to put competitive pressure on Generators through the wholesale spot market or the contract market. However, there is little point in enabling retail competition until the wholesale market has become relatively competitive. There is a view that retail competition itself provides the pressures for competition in the wholesale market. Practical experience from markets that introduced full retail competition, without providing an effective competitive wholesale market (e.g. California), suggests that it is necessary to get the wholesale market reasonably competitive before allowing retail competition.

6.6.2. Supplier Risk

In a liberalized market, where a limited degree of retail competition for larger customers is introduced, this may result in significant risk to Suppliers. The main risks and the methods of mitigating these risks are:

- Loss of customers and revenue to competitors – the main reason for introducing competition is to cause this risk and so increase Suppliers' efficiency – it is therefore up to the Supplier to mitigate this risk. Suppliers need to keep their supply business costs as low as possible and be flexible to reduce these costs in the face of falling customer base.
- With competition, is important that Suppliers are not over-long in contracts. Thus, their commitment to buy forward, at agreed prices, by purchase contracts, should not exceed their customer load. This is not a problem for the non-competitive (franchise) market but is a real problem with respect to the competitive market (eligible customers). Suppliers need to be very careful about overly committing themselves with regard to purchase contracts.
- For Oblenergos, there is a risk that they have to supply franchise customers at regulated tariffs that may not adequately cover the purchase costs (or other costs, such as use-of-system charges). This a regulatory risk faced by the Oblenergos. To mitigate this risk, it is important that all Suppliers should be treated equitably. Thus, Oblenergos should have

access, on a non-discriminatory basis, to eligible customers. Similarly, if there is an obligation to supply franchise customers below cost (subsidies) theses costs should be reimbursable in some way.

6.7. Pool Price Monitoring

To monitor the effectiveness of the wholesale market, an essential element is to monitor the effects in terms of price. Thus, routine and consistent monitoring of pool prices, including the individual components of price (SMP, Capacity Price and Flexibility Price), should be carried out. The most effective way for NERC to do this is for NERC to determine what results it wants to see and request the Market Operator to provide the information on a monthly basis, to all participants and other interested parties. Publication of an agreed set of key data on the Internet would be the most effective method.

Having provided the infrastructure for pool price monitoring, NERC should then define how such data is to be used to monitor the effectiveness of competition in the WEM. An effective method adopted by other regulatory authorities is to use summaries of pool prices to support arguments for change in a discussion paper. This prompts debate but within a framework set by the pool price data and subject of proposed reform, rather than ad-hoc proposals and counter-proposals, which is the current fashion.

Proposals for reform of the WEM should be subject to analysis, which could be specifically commissioned by NERC or be provided by market participants in response to a debate on issues. The key element of such an approach is that, prior to change, it is preferable where possible to analyze the impact a priori. Additionally, a shadow period of operation with the changes could be involved, where the changes are effected but not in financial terms. Most importantly, it is necessary for an appropriate period of time to elapse before making further changes that could impact on the results.

6.8. Contract Market Monitoring

When a contract market is established, it will be necessary for NERC to monitor the effectiveness of the market. However, unlike the wholesale spot market, contract markets are usually informal and voluntary. The exceptions are situations where certain contract requirements are imposed as a regulatory necessity, for example the rationing of nuclear and hydro contract discussed in Section 4.8.

Another issue to be aware of during Phase 1 is the possibility of interactions between the pool and contract markets. For example, if Generators are fully contracted, they would be relatively indifferent to the pool price, since their revenue would be determined by the contracts rather than the pool price. This could affect their bidding behavior and would be a suitable issue for NERC to monitor.

7. Reliability and Quality of Supply

This section is included to indicate how economic mechanisms might be applied to enhance the reliability and quality of supply.

One of the main concerns about competition is that, by concentrating on price, reliability and quality might suffer. This is a genuine concern and one that has been tackled elsewhere by a market mechanisms and regulation.

7.1. Reliability

The reliability of the power system is affected by generation and network reliability. The latter is a matter for regulation of the transmission and distribution businesses. Generation reliability is determined by:

- The reliability of individual power plants;
- The overall amount of capacity available to the system; and
- How the availability is managed to ensure that demand is met.

The most effective economic mechanism to ensure that adequate capacity is made available is a properly operating competitive wholesale market. In such an environment, new entrants are encouraged and Generators have to compete actively to ensure that plant is dispatched. This is more effective than a centrally planned system, where either too much or too little capacity can often result.

Where individual power plants are inherently unreliable because they are old or poorly maintained, a competitive market environment provides the incentives to retire such plant and replace the capacity with newer plant. However, in the short term, costs may be a limiting factor. There are, however, short term measures that could be used to improve plant reliability by providing the right incentives for Generators to maximize availability. The use of the Capacity Price, coupled with penalties for poor availability could provide such an incentive. In addition, the existing price structure of the WEM already produces an incentive for Generators to maximize their plant availability, since they earn pool price revenue generally in excess of marginal costs.

Managing the available plant to ensure that demand is met involves a demand forecast. The question has been raised as to whether or not the demand forecast would be improved by requiring Suppliers to provide their own forecast of demand requirements and also to penalize them for forecast errors. It has to be remembered, however, that the WEM is very much a one-side market, where prices are determined solely by Generators (and regulation). In a two-sided market (such as a balancing market) demand and generation are considered to be equivalent and opposite. In these markets, automatic incentives apply to generation and demand to forecast their requirements as accurately as possible. However, in the current WEM and during Phase 1, Generators will continue to dominate. It would therefore be inappropriate to place penalties on Suppliers for inaccurate demand forecasts when they already are disadvantaged vis-à-vis Generators. Furthermore, it is most likely that the sum of demand forecasts from individual Suppliers would be less accurate than the centralized demand forecast currently produced by the Market Operator.

7.2. Quality

In a wholesale electricity market, supply quality is maintained by the System Operator. It is therefore difficult to provide economic mechanisms to enhance quality of supply, other than

the indirect pressure from customers via the regulator. However, NERC should view this as an important aspect of regulation of the System Operator. Possible incentive mechanisms are discussed in Section 4.4.

8. International Trading

The following types of international trade may exist:

- Export, from generating units not synchronized with the Ukrainian grid (e.g. Poland, Hungary).
- Export, from generating units synchronized with the Ukrainian grid (e.g. Moldova, Russia)
- Imports into the Ukrainian grid (e.g. from Russia).
- Transit of power, by a foreign party, via the Ukrainian grid (e.g. by Russia to Moldova).

Questions have arisen as to what form of market membership is relevant in any of the above situations. Also, there is the issue of foreign entities not being eligible for a license in Ukraine.

8.1. Options for dealing with exports and imports

There are various options for dealing with exports and imports. However, some of the options may be more acceptable than others. First, however, the options are listed below to examine the range of possibilities. The following section then recommends options for possible utilization, based on a combination of practicality and acceptability.

(1) For the situation where exports are from non-synchronized generating units, these are not part of the Ukrainian grid and therefore not part of the WEM. Therefore, there is not really an issue with regard to export from these units. There may be a concern, however, that a Generator with the flexibility to synchronize units into and out of the Ukrainian grid has an unfair advantage over other Generators, with regard to the obligation to declare their plant available. This could perhaps be handled by a special license condition in such situations.

(2) Under a limited single buyer role, the Market Operator could assume responsibility as the International Trader. However, given the concerns about the Market Operator entering into trading operations, this is likely to be opposed. It may be possible, however, to negate any possibility of access to funds by back-to-back contractual arrangements. This would mean that, while the Market Operator was the buyer/seller in name in respect of export and import, it would simply be an intermediary between principals.

(3) An alternative to (2), in respect of exports, Generators could obtain the necessary permits/licenses from the appropriate Government Department for export of generation. Supply licenses are not relevant to exports since they are not for supply to domestic users. There would need to be a general license condition on Generators to ensure that the power exports did not provide a means of avoiding the obligation to declare available capacity. Other specific conditions may also be necessary. In the case of synchronized units, there would also be a need to deal with the case where the exports exceeded the output of the exporting Generator, which could occur at any time. This may require the foreign party to become an external member of the WEM. This would mean that pool prices could be charged for any excess of exports over output from the exporting Generator. This option, however, means that exporting Generators would be able to avoid selling their export power to the pool and, although a practical option, this might not be acceptable.

(4) With regard to imports, an alternative to the International Trader Role for the Market Operator would be to allow Ukrainian entities to contract with a foreign entity for import of power (subject to obtaining whatever permits/licenses necessary from the appropriate Government Department). In this situation, it would also be necessary to ensure that such

entities paid for any power not provided by imports, at the WEM pool price. This would suggest that such parties should be Suppliers in the WEM. An alternative would be to allow a "trader" class of pool member, i.e. an entity that does not supply or generate within Ukraine. Again, however, this option provides a degree of pool bypass for importers and thus, may be unacceptable.

There are other practical considerations in respect of imports:

- What if the imports exceed the level of total demand for which the Supplier is responsible and what happens to the balance?
- Should the importing party have an obligation to declare the intended level of imports, similarly to domestic Generators?
- Should the import level be included in the schedule used to set SMP?

8.2. Recommended method of dealing with exports and imports

Taking into account the options discussed above but also issues of practicality and acceptability, the recommended approach for dealing with exports, imports and transit arrangements (apart from any exports from non-synchronized generating units) is as follows:

- As far as possible, treat imports and exports like other trades within the WEM (i.e. imports are similar to generation and exports are similar to domestic consumption). The exception is for exports from non-synchronized units (see above point 1 in Section 8.1).
- For all other imports to and exports from Ukraine, an "External Party", outside Ukraine, would be required to become a party to the WEM under the special class of "External Party". Such entities would not be issued with licenses, since NERC is not empowered to issue licenses to foreign entities but, by being a party to the WEM, the External Party would be contractually bound to the WEM under Ukrainian law.
- External Parties would be responsible for any consumption of power taken over designated interconnections, according to WEM Market Rules and pool prices. Such External Parties would be required to provide the Market Operator (or System Operator) with forecasts of demand requirements on a regular basis, according to agreed timescales. Agreed transmission prices would apply to such exports of power from Ukraine, on a similar basis to transmission pricing for domestic Suppliers.
- External Parties would also be responsible for any power transmitted to Ukraine over designated interconnections. They would be subject to scheduling and dispatch, similar to domestic Generators and be paid according to the WEM Market Rules and prices. Additionally, agreed transmission prices may apply to such imports of power on a similar basis to transmission prices for domestic Generators.

9. Appendix 1 – Relationship between System Operator and Market Operator in the WEM

Discussions were held with representatives of the System Operator (NEK Ukrenergo) and the Market Operator (Energomarket), in order to clarify certain aspects of responsibility between the two entities. The following is a brief summary of these discussions.

1. Demand Forecasting

The Market Operator (MO) has the responsibility for producing the daily forecast of system demand. Special software is used, based on historic data, taking into account weather and other relevant variables or special events such as football matches. Large customers provide a forecast of their demand requirements, including losses. The forecast of system demand is day-ahead for each separate hour. Generally, the forecast is close to the actual out-turn demand, except in situations such as the recent long holiday period at the beginning of May.

The System Operator (SO) also carries out a load forecast, in parallel with the MO, since they have the duty to do so. However, it appears that the SO forecast is sent to the MO to do the "final" version.

2. Generation Availability Declaration

All of the technical data from Generators is sent via the Regional Centers to the SO. Price bids are sent from the Regional Center to the MO. The SO does not see the price bids. The price bid data consists of technical and economic data. Technical data consists of minimum/maximum loads, operating times, etc. Economic data consists of prices for no load, start-up and generation. Technical data may be re-bid during the day.

3. Generation Schedule

The MO produces the day-ahead schedule, using special software to validate the bid data and to produce an optimized schedule according to price bids. This software (V2) was originally with the SO but is now with the MO. It is based on the principle of economic dispatch. It is not clear, however, whether or not this software uses inter-temporal optimization between the individual hours[14]. The costs of starting units that run for only a few hours need to be properly allocated and it is not clear how this is achieved within the software. A related issue is that the schedule should be based on availability, as declared by the Generator and price. The question as to whether or not sufficient fuel is available at the power plant is not a matter for the Market Operator. Any issues relating to fuel constraints and the impact on availability declarations are for NERC to investigate.

4. Generation Dispatch

The MO schedule is issued to the SO who uses this schedule as the basis for actual dispatch. (This was confirmed by both the SO and the MO). With regard to transmission constraints,

[14] In a competitive market, prices fluctuate significantly from one hour to the next. This is particularly so with thermal generation markets. In assessing which bids to utilize for generation, it is important to examine the inter-temporal effect within a day, since costs are affected by start-ups and other issues relating to thermal plant.

these are not significant with the exception of Lugansk[15]. There are certain other "bottlenecks" in the system but generally these do not affect thermal plant and so do not impact on SMP. Therefore, there is little need to deviate from the schedule. However, it was confirmed that there is liaison between the MO and the SO concerning the practicality of the schedule. Changes in generation availability or demand can be made with reference to the schedule.

5. Determination of SMP

The software that produces the SMP works on the basis of ex-ante SMP. There is no calculation of ex-post SMP in real time. However, ex-post SMP does not vary significantly from ex-ante SMP.

6. System Reserve

The large difference between maximum and minimum load is managed by a combination of hydro plant and utilizing some thermal plant in synchronous compensation mode. Mostly, however, the hydro generation provides the load following plant. Apparently, there is a large manual that dictates when the SO can or cannot use any particular hydro resource.

A spinning reserve of 300MW is generally held available. The largest unit on the system is 1000MW (900MW net) but around 600MW of reserve is provided by the Russian interconnection.

7. Exports and Imports

A special department within the MO is responsible for producing a weekly schedule of exports and imports.

[15] Lugansk was designed for operation of not less than 7 units but, because demand has fallen, only 2 units are dispatched.

10. Appendix 2 – Funds Clearance

Funds clearance is particularly important in the WEM due to the fact that the wholesale market is a mandatory gross energy market. Thus, all payments for all of the energy pass through the market. This is in contrast with most other wholesale electricity markets that operate as balancing markets. In such cases, the amount of energy that is paid via the market is relatively small and so funds clearance is not so large an issue.

Funds clearance within power exchanges operate in the same way as other commodity exchanges. Generally, market participants are required to make margin deposits, based on the market operator's assessment of the participant's net financial position.

1. England & Wales Pool

The market that existed in England & Wales, prior to the New Electricity Trading Arrangements (NETA) also worked as a gross energy mandatory pool. Funds clearance was operated by a completely separate subsidiary of the National Grid Company, responsible directly to the Market Operator (The Pool) for this function.

The principle of funds clearance in the England & Wales Pool was that all Suppliers had to demonstrate adequate funds to pay their pool bills, either by financial status or by actual deposits or letters of credit. The funds were cleared on a daily basis, 28 days in arrears. Suppliers had to deposit the required amount each day in a special account that was used to pay Generators the same day. Thus, no interest accrued in the account and all monies paid in were paid out the same day. The funds clearance company had no access to the funds.

2. Nord Pool

Nord Pool is a voluntary market that provides a power exchange for market participants. A separate subsidiary of Nord Pool provides the clearing function and is licensed to do so under the relevant financial legal requirements in Norway. A fundamental principle is that it guarantees payments of all trades. This is made possible by acting as counterparty to all trades. Nord Pool requires participants to post security sufficient to cover estimated losses that Nord Pool would incur if a participant defaulted and Nord Pool had to make closing transactions for the defaulting participant's positions. A special operating system, designed and used by the Chicago Mercantile Exchange, is used for this purpose.

3. UK Power Exchange

The UK Power Exchange, one of the principal players in the UK's New Electricity Trading Arrangements, operates a settlement and clearing function for the trades carried out by market participants. It operates similarly to Nord Pool, with Margin Payments being required by market participants in relation to their expected market positions on a daily basis.

11. Appendix 3 – Contract Sculpting

This appendix provides a brief explanation of "sculpting" in power contracts, which may be used either in physical contracts (bilateral market) or Contracts for Differences (in a pool).

The main reason for contracts is to provide parties, whether Generators or Suppliers, as a means of fixing their prices, for agreed amounts of power, in advance. However, it is impossible to forecast in advance exactly what amount of power a Supplier will need or that a Generator can provide.

For the Supplier, its demand is dictated by the use of power by its customers. This will vary with many factors, including:

- Temperature and other climatic factors;
- The time of year (e.g. lighting);
- Economic conditions (particularly for industrial customers);
- General load growth; and
- Random variations in demand.

For the Generator, its output is subject to:

- Scheduling and dispatch (which may be affected by its own offers);
- Temperature (for some types of thermal plant);
- Fuel availability (especially hydropower);
- Fuel quality;
- Planned maintenance;
- Breakdowns and unplanned maintenance;
- Method of operations; and
- Degradation of the plant efficiency over time.

Thus, for both Suppliers and Generators there is significant uncertainty but there is also an expected variability in the shape of the demand/generation over a period of time. It is only possible to allow for the uncertainties on a probabilistic basis. However, it is possible to forecast the expected general shape of the demand and generation output, over a period of time. The contracts can take account of these expected variations, known as "sculpting" the contract amounts.

For example, a Supplier will have a forecast load shape for the following year, based on analysis of historic demand, perhaps over several years, with an allowance for load growth and any expected changes in load pattern. The actual load experienced next year will not be precisely the same as the load forecast, either in shape or even in average level, due to the uncertainties. A good forecast should be accurate to within a few percentage points on average over a year but in individual hours of the year, the forecast will probably be much less accurate. However, the load forecast is the best basis for agreeing contracts to cover the demand.

From a Generator's perspective, similar considerations apply. A forecast output can be made, allowing for the relevant factors, thus providing the Generator with the best basis for agreeing contracts to cover its output.

Suppliers' forecast loads will be very different from Generators' forecast output, because of size and shape. The contracting process, whether freely negotiated or regulated, involves comparing both sets of load shapes to get the best match. In freely negotiated contracts, price is also important and it may be that, if the contract price is too high, it is better to take a risk on pool prices for at least part of the load/output.

The result is likely to be that contracts will be designed to accommodate, to an approximate degree, the underlying load shape or generation output. Suppliers and Generators will have a portfolio of contracts, so it is the overall portfolio shape that matters to them. Thus it is not necessary to be too precise in matching the shapes of individual contracts to requirements. However, it is expected that many contracts would be "sculpted" to provide an approximation.

An example of a "sculpted" contract is where the contract amount and price is specified separately for a number of different periods during the contract term. In a one-year contract, the periods might be:

- Night hours.
- Day hours (summer)
- Day hours (spring/autumn)
- Day Hours (non-peak) winter
- Day hours (peak) winter

Or other more complex patterns, depending on the requirements for "sculpting". Different amounts can be agreed (with different prices if appropriate) for each of the periods in the contract.

In the event, because the shapes will not match the actual load or generation output, there will be differences between the contract amount and the actual demand/generation. For individual contracts, this is not so important since the overall contract portfolio is providing the risk cover. However, since even small differences could be expensive, for either party, there is an incentive to get the overall balance between contracted and actual amounts as close as possible. Thus, in liquid contract markets, there are a variety of arrangements for "fine-tuning" one's contract position, close to real time.

A question has been raised as to how the regulatory treatment of contracts is affected by sculpting. Regulatory issues arise with regard to contracts in the following situations:

- Where contracts are rationed (e.g. nuclear and hydro contracts)
- Where contracts are applied to a specific market sector (e.g. eligible customers or the non-eligible franchise market)

With regard to contract rationing and nuclear contracts in particular, nuclear generation is by nature a flat shape, since it occupies the base load part of the load curve. Therefore, rationing by simple volume would mean that those Suppliers that supplied high load factor customers would actually have a smaller part of the base load covered by nuclear contracts than those Suppliers that supplied low load factor customers. This is not necessarily unjust but it is a matter for regulatory consideration as to how the rationing should apply. An alternative to simple volume rationing would be to ration according to the load shape actually supplied but this is not recommended because:

(a) It would become complex to administer; and

(b) It could become subject to abuse by suppliers and customers

With regard to the regulation of contracts applied to specific market sectors, NERC would have to ensure that any Supplier had allocated a fair share to both market sectors. Thus, some assessment of the overall load shape of Suppliers is inevitable but this should not necessitate the assessment of individual customer load shapes from a regulatory perspective.